

AD-A076 724 ARMY RESEARCH INST FOR THE BEHAVIORAL AND SOCIAL SCIE--ETC F/G 5/10  
A COMPARISON OF THREE-SUBTEST AFQT AND FOUR-SUBTEST AFQT.(U)  
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UNCLASSIFIED ARI-RM-74-5 NL

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14 ARI-RM-74-5

Army Project Number

16 20162177A745

Training Technology & Classification

9 Research Memorandum 74-5

6 A COMPARISON OF THREE-SUBTEST AFQT AND FOUR-SUBTEST AFQT

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## A COMPARISON OF THREE-SUBTEST AFQT AND FOUR-SUBTEST AFQT

### PROBLEM

The new AFQT-9 and -10, still under development, and the AFQT score obtained from the Armed Services Vocational Aptitude Battery (ASVAB) have only three subtests: arithmetic reasoning, word knowledge, and pattern analysis; the tool knowledge items have been deleted. The three service laboratories agreed that the tool knowledge subtest did not contribute enough to the validity of the AFQT to warrant including it. (Validity data for the AFQT subtests are presented in the Appendix.) Tool knowledge items have been dropped from the new Army Classification Battery (ACB) and from the new Navy Basic Test Battery, which is about to be introduced for operational use.

The deletion of the 25 item tool knowledge test has given rise to a concern of the effects upon individual performance, especially of the low scoring person. Individuals with low scores on AFQT usually obtain higher mean scores on the tool knowledge test than on the other subtests. This is reflected in the lower correlation between tool knowledge and the remaining three subtests than between each of the other subtests. Score distributions of the three and four subtest batteries were compared and analyzed in order to determine the effects of deleting the tool knowledge items.

### VARIABLES

1. AFQT-7D and -8D. This version of the AFQT contains four 25-item subtests: arithmetic reasoning, word knowledge, pattern analysis, and tool knowledge. This version of the AFQT has been in operational use throughout the 1960's, and was administered to millions of men. Repeated samples have shown that the distribution of scores remained similar to the original standardization.
2. ASVAB four-subtest AFQT. The Armed Services Vocational Aptitude Battery (ASVAB) is an inter-service battery designed to measure the content common to the service classification batteries. The four subtests of the ASVAB are parallel to the subtests of AFQT-7D and -8D. Each subtest contains 25 items. The correlation between the ASVAB four-subtest AFQT and AFQT-7D and -8D is in the range .85-.90 as found in several large samples.
3. ASVAB three-subtest AFQT. A three-subtest AFQT, which does not contain tool knowledge items, was also obtained from ASVAB. The ASVAB three-subtest AFQT has correlations in the range .83-.88, as found in several samples with AFQT-7D and -8D. The ASVAB four-subtest and three-subtest AFQT scores correlate .97. Beginning September 1973, the ASVAB three-subtest AFQT is the operational AFQT score obtained from ASVAB.

4. ACB three-subtest AFQT. Beginning 1 July 1973 an experiment was initiated in which AFQT-7D and -8D were no longer administered to Army applicants for enlistment. For the duration of the experiment, an AFQT score is derived from the three subtests of the ACB. These are arithmetic reasoning, word knowledge, and pattern analysis. Each of these subtests has 20 items for a total of 60 items in the ACB AFQT. The correlation of ACB AFQT and AFQT-7D and -8D is .84 in a large sample of 3,760 men. No correlation with ASVAB AFQT scores is available.

#### PROCEDURE

A large representative sample of about 2500 men at Armed Forces Examining and Entrance Stations (AFEES) was obtained in 1972 to standardize new forms of the ASVAB. AFQT-7D and -8D scores were also obtained for this sample. The correlations between ASVAB AFQT and AFQT-7D and -8D reported above were obtained on subgroups of this sample. Both four-subtest and three-subtest ASVAB AFQT scores were obtained for each man in the sample. The three-subtest AFQT is being used operationally in ASVAB beginning September 1973. Three joint distributions of AFQT scores were obtained for the AFQT scores; these are: AFQT-7D and -8D vs. ASVAB four-subtest AFQT; AFQT-7D and -8D vs. ASVAB three-subtest AFQT; and ASVAB four-subtest AFQT vs. ASVAB three-subtest AFQT.

A smaller experiment was conducted on about 300 Army accessions at Ft. Jackson, SC to obtain an estimate of the relationship between the ACB AFQT and AFQT-7D and -8D. Since this sample is restricted to Army accessions the results are not representative of men in the extreme low range. Men who had previously failed the ACB AFQT at AFEES were excluded. Also people who had failed to qualify on the aptitude area standards (1-90 for high school graduates and 2-90's for non-graduates) were also excluded. The AFQT-7D and -8D was administered and the three ACB subtests that compose the AFQT (arithmetic reasoning, word knowledge, and pattern analysis) were readministered at the Ft. Jackson reception station. A different form of the ACB AFQT was administered at the reception station as compared to the AFEES.

The AFQT scores were grouped into administratively convenient categories for presentation. The scores are reported on the percentile scale. The percentile score categories are as follows:

#### AFQT Percentile Score

#### Mental Category

0-9	V
10-19	lower IV
20-30	Upper IV
31-49	lower III
50-69	upper III and bottom of II
70-100	II and I

## RESULTS

The joint distributions are presented in Tables 1-4. In each table, frequency counts are shown in Part A and percentages are presented in Part B. The frequencies show the number of men in each AFQT score category and the distribution within each score category. For example in Table 1, which shows the relationship between AFQT-7D and -8D and the ASVAB four-subtest AFQT, there were 129 men who scored 0-9 on AFQT-7D and -8D. Of these 129, 88 also scored 0-9 on the ASVAB four-subtest AFQT, and 36 scored 10-19 on the ASVAB AFQT. Five scored 20-30 on the ASVAB four-subtest AFQT and none scored higher. The total number of men in the sample was 2494.

In Part B of each table the number of men in each column is converted to percentages. The numbers show the percentage of men in each column who scored in the various score categories on the other test. The sum of the percentages in each column is 100, within rounding error. The numbers shown in the Total row show the percentage of the total sample that scored in each category. For example in Table 1, 19 percent of the sample (482 of 2494) scored in the AFQT-7D and -8D score category 31-49. Of the 482 men in this category, 20 percent scored in the next lower category (20-30) on the ASVAB four-subtest AFQT, 49 percent scored in the same category, and 24 percent were in the next higher category (50-69). The percentage of men in each row is shown in the final column of Part B of each table. In Tables 1, 2, and 4 the percentages in each column are based on the number of men in each AFQT-7D and -8D score category. In Table 3 the column percentages are based on the number in each ASVAB four-subtest category.

The pattern of results is similar in each table. The men tended to obtain similar scores on the two versions of the AFQT. Some of the men scored higher on one test and others scored lower, and many scored in the same category. There were no systematic differences on the three-part vs. four-part comparisons. In general, men who scored low on the four-subtest AFQT did better on the one with three-subtests, and conversely, men who scored low on the three-subtest AFQT tended to score higher on the four-subtest AFQT. The distributions can be readily explained by the regression effect, which operates in any pair of variables that are not perfectly correlated.

The extent of the shift in scores from the four-subtest AFQT to the three-subtest version is exaggerated by the mode of display. In Table 3 the four- and three-subtest ASVAB AFQT's are compared. The correlation between these two is .97, which is close to perfect, and yet there are sizable percentages in different categories. Of the 301 men who scored 20-30 on the four-subtest ASVAB AFQT, 55 percent scored in the same category on the three-subtest form, but 20 percent scored in the lower adjacent category and 24 percent scored in the higher adjacent one. The remaining one percent was further removed on the three-test AFQT. The seemingly large shift in scores arises primarily because of small score changes at the boundaries of the categories. In the other tables where the correlation is lower, the score changes are larger. The greater change is reflected in the greater dispersion of scores in each column in Tables 1, 2, and 4 as compared to Table 3.



The results in Table 4 compare the ACB AFQT, used in the experimental standards effective 1 July 1973, and AFQT-7D and -8D, used operationally until 1 July 1973. The results are consistent with those obtained on the larger and more representative ASVAB samples. At the lower AFQT-7D and -8D categories, more men had higher scores on the ACB AFQT. Conversely, at the upper end, more men had lower scores on the ACB AFQT. Again the results reflect primarily the regression effect.

There is no evidence that the standardization of the ACB AFQT is not satisfactory. Generally there are no gross discrepancies between ACB AFQT and AFQT-7D and -8D in the percentage of cases in each score category. Data collected on the July 1973 applicants confirm the appropriateness of the conversion tables for ACB AFQT.

#### CONCLUSIONS

It is clear from the results that the three-subtest AFQT has a score distribution similar to that of the four-subtest AFQT. Individuals with low scores on the four-subtest AFQT sometimes had higher scores, sometimes had lower scores, and usually had similar scores on the three-subtest AFQT. The same pattern held for men with high scores. No part of the distribution was systematically different on the two kinds of AFQT.



Table 1

## COMPARISON OF AFQT-7D AND -8D WITH ASVAB FOUR-SUBTEST AFQT

## Part A. Frequency Count in each Score Category

ASVAB Four- Subtest AFQT Percentile Score Category	AFQT-7D and -8D Percentile Score Category						Total
	0-9	10-19	20-30	31-49	50-69	70-100	
<u>0- 9</u>	88	55	11	10	02	01	167
<u>10- 19</u>	36	85	37	16	06	00	180
<u>20- 30</u>	05	86	94	95	18	03	301
<u>31- 49</u>	00	32	80	236	148	22	518
<u>50- 69</u>	00	02	13	114	289	181	599
<u>70-100</u>	00	04	02	11	110	602	729
<u>Total</u>	129	264	237	482	573	809	2494

## Part B. Percentage in each Score Category

ASVAB Four- Subtest AFQT Percentile Score Category	AFQT-7D and -8D Percentile Score Category						% of Total
	0-9	10-19	20-30	31-49	50-69	70-100	
<u>0- 9</u>	68	21	05	02	01	00	07
<u>10- 19</u>	28	32	16	03	01	00	07
<u>20- 30</u>	04	33	40	20	03	01	12
<u>31- 49</u>	00	12	34	49	26	03	21
<u>50- 69</u>	00	01	05	24	50	22	24
<u>70-100</u>	00	01	00	02	19	74	29
<u>% of Total</u>	05	11	10	19	23	32	100

Table 2

## COMPARISON OF AFQT-7D AND -8D WITH ASVAB THREE-SUBTEST AFQT

## Part A. Frequency Count in each Score Category

ASVAB Three- Subtest AFQT Percentile Score Category	AFQT-7D and -8D Percentile Score Category						Total
	0-9	10-19	20-30	31-49	50-69	70-100	
<u>0- 9</u>	86	49	08	07	03	00	153
<u>10- 19</u>	35	101	49	32	04	03	224
<u>20- 30</u>	06	68	79	96	22	03	274
<u>31- 49</u>	00	37	79	200	136	31	482
<u>50- 69</u>	00	05	21	116	268	213	623
<u>70-100</u>	01	04	01	31	142	565	744
<u>Total</u>	127	264	237	482	575	815	2500

## Part B. Percentage in each Score Category

ASVAB Three- Subtest AFQT Percentile Score Category	AFQT-7D and -8D Percentile Score Category						% of Total
	0-9	10-19	20-30	31-49	50-69	70-100	
<u>0- 9</u>	68	19	03	01	00	00	06
<u>10- 19</u>	28	38	22	07	01	00	09
<u>20- 30</u>	04	26	33	20	04	01	11
<u>31- 49</u>	00	14	33	42	24	04	19
<u>50- 69</u>	00	02	09	24	46	26	25
<u>70-100</u>	00	01	00	06	25	69	30
<u>% of Total</u>	05	10	10	19	23	33	100

Table 3

## COMPARISON OF ASVAB FOUR-SUBTEST AFQT WITH ASVAB THREE-SUBTEST AFQT

## Part A. Frequency Count in each Score Category

ASVAB Three-Subtest AFQT Percentile Score Category	ASVAB Four-Subtest AFQT Percentile Score Category						Total
	0-9	10-19	20-30	31-49	50-69	70-100	
<u>0- 9</u>	138	15	00	00	00	00	153
<u>10- 19</u>	29	135	61	01	00	00	226
<u>20- 30</u>	00	28	165	81	00	00	274
<u>31- 49</u>	00	02	73	320	89	00	484
<u>50- 69</u>	00	00	02	113	393	106	614
<u>70-100</u>	00	00	00	03	113	625	741
<u>Total</u>	167	180	301	518	595	731	2494

## Part B. Percentage in each Score Category

ASVAB Three-Subtest AFQT Percentile Score Category	ASVAB Four-Subtest AFQT Percentile Score Category						% of Total
	0-9	10-19	20-30	31-49	50-69	70-100	
<u>0- 9</u>	83	08	00	00	00	00	06
<u>10- 19</u>	17	75	20	00	00	00	09
<u>20- 30</u>	00	16	55	16	00	00	11
<u>31- 49</u>	00	01	24	62	15	00	20
<u>50- 69</u>	00	00	01	22	66	15	24
<u>70-100</u>	00	00	00	00	19	85	30
<u>% of Total</u>	07	07	12	21	24	29	100



Table 4

## COMPARISON OF AFQT-7D AND -8D WITH ACB AFQT

## Part A. Frequency Count in each Score Category

ACB AFQT Percentile Score Category	AFQT-7D and -8D Percentile Score Category						Total
	0-9	10-19	20-30	31-49	50-69	70-100	
<u>0- 9</u>	01	12	05	03	01	00	22
<u>10- 19</u>	03	21	17	06	03	00	50
<u>20- 30</u>	03	10	11	09	01	00	34
<u>31- 49</u>	03	19	18	34	11	06	91
<u>50- 69</u>	00	02	11	11	23	09	56
<u>70-100</u>	01	01	00	07	11	32	52
<u>Total</u>	11	65	62	70	50	47	305

## Part B. Percentage in each Score Category

ACB AFQT Percentile Score Category	AFQT-7D and -8D Percentile Score Category						% of Total
	0-9	10-19	20-30	31-49	50-69	70-100	
<u>0- 9</u>	-	18	08	04	02	00	07
<u>10- 19</u>	-	32	27	09	06	00	16
<u>20- 30</u>	-	15	18	13	02	00	11
<u>31- 49</u>	-	29	29	48	22	13	30
<u>50- 69</u>	-	03	18	16	46	19	18
<u>70-100</u>	-	02	00	10	22	68	17
<u>% of Total</u>	04	21	20	23	16	15	99

# APPENDIX

## VALIDITY COEFFICIENTS OF THE PARTS OF AFQT

AFQT Part	MOS Group <sup>a</sup>									Mean
	CO	FA	EL	OF	SC	MM	GM	CL	ST	
Arith. Reas.	.44	.55	.58	.33	.60	.55	.55	.62	.62	.54
Word Knowl.	.39	.49	.54	.30	.56	.53	.51	.63	.60	.51
Spatial Rel.	.38	.37	.49	.25	.51	.50	.38	.37	.49	.42
Tool Knowl.	.30	.39	.42	.26	.32	.53	.43	.24	.29	.35

Validity of three-part AFQT (AR, WK, and Spatial) = .59  
 Validity of four-part AFQT (AR, WK, Spatial, and TK) = .60

<sup>a</sup> CO - Combat; FA - Field Artillery; EL - Electronics Repair; OF - Operators and Food; SC - Surveillance/Communications; MM - Mechanical Maintenance; GM - General Maintenance; CL - Clerical; ST - Skilled Technical

Source: Maier, M. H., and Fuchs, E. F. Development and Evaluation of a New ACB and Aptitude Area System. ARI Technical Research Note 239. September 1972.